

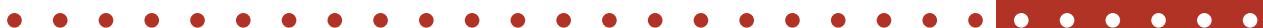
# Chapter 9

## **THE FRAMEWORK: STUDENTS WITH DIVERSE NEEDS**

**Part A:** Science Instructional Adaptations for  
Students with Disabilities

**Part B:** Science Instructional Adaptations for  
Students with Limited English Proficiency

**Part C:** Science Instructional Adaptations for  
Exceptionally Able Students



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## PART A: SCIENCE INSTRUCTIONAL ADAPTATIONS FOR STUDENTS WITH DISABILITIES

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### INTRODUCTION

The *New Jersey Core Curriculum Content Standards* and related curriculum frameworks are the focus of curriculum and instruction for all pupils. This population includes students with disabilities. In order to provide pupils with disabilities meaningful access to curriculum and instruction based on the content standards, adaptations may be required. Adaptations are not intended to compromise the content standards. Instead, adaptations provide students with disabilities the opportunity to maximize their strengths and compensate for their learning differences.

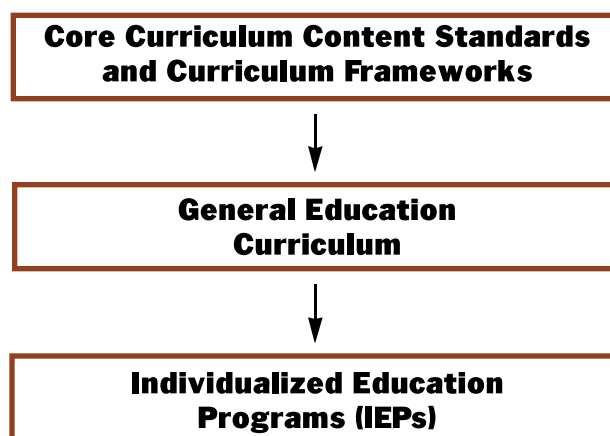


Figure 1

Consistent with the expectation that students with disabilities participate in the general education curriculum, is the requirement that the Individualized Education Programs (IEPs) of students with disabilities, reflect the core content standards and the local school district's general education curriculum (see Figure 1).

## ADAPTATION: A FEDERAL REQUIREMENT

**The Individuals with Disabilities Act Amendments** of 1997 and Section 504 of the Rehabilitation Act of 1973 guarantee students with disabilities the right to general education program adaptations, as specified in their Individualized Education Programs (IEPs) or 504 plans. These federal requirements are intended to result in adaptations that provide these pupils access to the general education program and general education curriculum.

Students with disabilities demonstrate a broad range of learning, cognitive, communication, physical, sensory, and social/emotional differences that may necessitate adaptations to the general education program. Each pupil manifests his learning abilities, learning style, and learning preferences in a unique way. Consequently, the type of adaptations needed and the program in which the adaptations will be implemented, are determined individually within the Individualized Education Program (IEP) or 504 planning processes (see Figure 2).

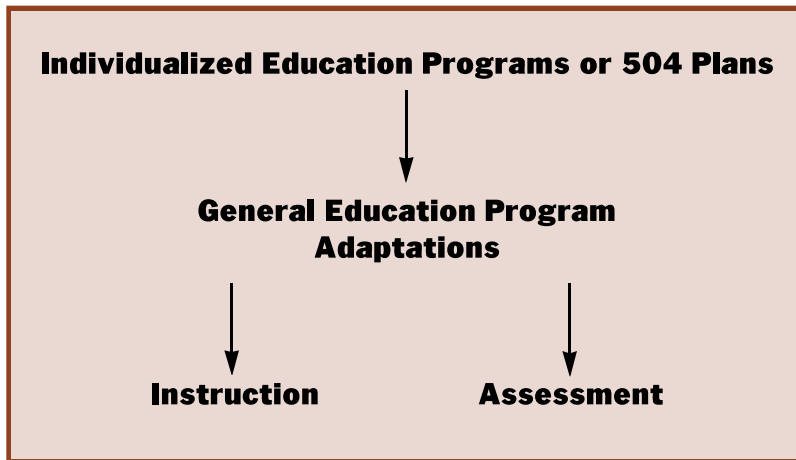


Figure 2

Within the content of the Science Framework Learning Demonstration Activities, adaptation is defined as:

***Any adjustment or modification to the general education program enabling students with disabilities to***

- participate in and benefit from learning activities and experiences based on the *Core Curriculum Content Standards*
- demonstrate understanding and application of the content standards

## CATEGORIES OF ADAPTATIONS TO THE LEARNING ACTIVITIES IN THE NEW JERSEY SCIENCE CURRICULUM FRAMEWORK

The Science Framework contains a variety of activities that emphasize hands-on learning experiences. These experiences can provide a valuable bridge between the general language of the standards and the greater specificity of the district's science curriculum. Consequently, adaptations to the hands-on experiences were identified to complement and make accessible this type of instruction.

**Note:** Additional adaptations may be needed to complement lecture and textbook teaching formats.

The categories listed below are intended to guide the process of selecting adaptations to the *Science Framework's* learning activities for an individual pupil with disabilities. Adaptations include, but are not limited to, the following:

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### Instructional Presentation

*Instructional Preparation*  
*Instructional Prompts*  
*Instructional Application*  
*Instructional Monitoring*

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### Classroom Organization

*Instructional Groups*  
*Instructional Support*  
*Environmental Conditions*  
*Adaptive Equipment*

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### Student Response

*Response Format*  
*Response Procedures*

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### Safety Considerations

*Safety Rules and Procedures*  
*Safe Use of Equipment*

## DESCRIPTIONS OF ADAPTATIONS TO THE LEARNING ACTIVITIES IN THE NEW JERSEY SCIENCE CURRICULUM FRAMEWORK

Descriptions—including the rationale, specific functions, and example for each category of adaptation—are provided below. Following these descriptions are sample adaptations to selected learning activities of the *Science Framework*.

**Note:** The adaptations listed below are based on effective instructional practices for all students. While these strategies can be beneficial to all students, they may be an essential component of the instructional program for a student with disabilities.

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### INSTRUCTIONAL PRESENTATION

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**Rationale:** Students with disabilities may require instructional presentations that will enable them to acquire, comprehend, recall, and apply science content and related processes. In addition, instructional presentation adaptations can enhance a student's attention and ability to focus on instruction.

**Purpose:** The primary purpose of these adaptations is to provide special education students with teacher-initiated and teacher-directed interventions that prepare students for learning and engage students in the learning process (*Instructional Preparation*); structure and organize information (*Instructional Prompts*); foster understanding of new concepts and processes (*Instructional Application*); and promote student self-reflection and self-management regarding tasks demands, goal attainment, and performance accuracy (*Instructional Monitoring*) during the *Science Framework's* learning activities.

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### Instructional Preparation

#### **Purpose:**

- Motivate
- Establish purpose and goals of lesson
- Activate prior knowledge
- Build background
- Focus
- Organize

#### **Examples:**

- Previewing information/materials
- Advance organizers
- Brainstorming and webbing
- Questioning techniques
- K-W-L strategies
- Warm-ups
- Visual demonstrations, illustrations, and models

## Instructional Prompts

### ***Purpose:***

- Organize information
- Build whole-part relationships
- Cue associations and connections
- Highlight essential concepts
- Generate categorization and comparisons
- Activate recall
- Summarize

### ***Examples:***

- Graphic organizers
- Semantic organizers
- Outlines
- Mnemonics
- Analogies
- Feature analysis
- Color coding
- Labels

## Instructional Application

### ***Purpose:***

- Simplify abstract concepts
- Provide concrete examples
- Extend ideas and elaborate understanding
- Build connections and associations
- Relate to everyday experiences
- Promote generalization

### ***Examples:***

- Graphics
- Data charts
- Flow charts
- Drawings and other illustrations
- Dramatics - role play
- Field trips
- Games
- Puzzles
- Models
- Simulations
- Concept activities
- Application activities

## Instructional Monitoring

### ***Purpose:***

- Provide periodic (continuous) check for understanding
- Redirect attention
- Direct on-task behavior
- Promote participation
- Check progress
- Assist in goal setting
- Establish timelines
- Clarify assignments, directions, and instructions
- Provide reinforcement and corrective feedback
- Promote strategy use and generalization
- Manage student behavior and interactions
- Develop self-questioning and self-regulation

### ***Examples:***

- Segmenting techniques - task analysis
- Self-monitoring checklists
- Think-alouds
- Journal entries
- Portfolios
- Interviews
- Questioning techniques
- Student contracts
- Reward system

## CLASSROOM ORGANIZATION

***Rationale:*** Students with disabilities may require specific adaptations to classroom organization in order for them to be actively involved in the *Science Framework's* learning activities.

***Purpose:*** The primary purpose of these classroom organization adaptations is to maximize student attention, participation, independence, mobility and comfort; to promote peer and adult communication and interaction; and to provide accessibility to information, materials, and equipment.

### **Instructional Groups**

#### ***Examples:***

- Cooperative learning groups
- Peer partners - buddy system
- Teams

### **Instructional Support (from another individual)**

#### ***Examples:***

- Assist physically
- Clarify
- Prompt - cue
- Gesture - signal
- Interpret
- Reinforce
- Highlight
- Organize
- Focus

**Environmental Conditions****Examples:**

- Physical room arrangement
- Workspace
- Material accessibility
- Lighting
- Noise level
- Learning stations/lab stations
- Labeling equipment, stations, seat assignments
- Seating arrangements -seat assignment
- Portable units

**Adaptive Equipment****Examples:**

- Speech synthesizer
- Communication board
- Close-captioned video-TV/decoder
- Audiotaped material
- Braille
- Enlarged print
- Low-vision equipment (e.g., clock)
- Talking watch or calculator
- FM System
- Lap board

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**STUDENT RESPONSE**


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**Rationale:** Students with disabilities may require specific adaptations in order to demonstrate acquisition, recall, understanding, and application of science content and related processes.

**Purpose:** The primary purpose of student performance responses is to provide students with disabilities a means of demonstrating progress toward the lesson objectives related to the *Science Framework's* learning activities.

**Response Format****Examples:**

- Complete information organizers
- Interviews and discussions
- Illustrations and diagrams
- Models
- Observation/data charts
- Puzzles
- Debates
- Journal and portfolio entries
- Bulletin board displays
- Role playing
- Video/audiotapes
- Computer printout

**Response Procedure****Examples:**

- Extended time
- Practice exercises
- Interpreter
- Use of preferred response mode (e.g., written, dictated, or oral)



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## SAFETY CONSIDERATIONS

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**Rationale:** The Science Framework's learning activities are hands-on experiences that occur in the classroom, laboratory, or outdoors. Students with disabilities may require adaptations in order to ensure safe participation for themselves and others.

**Purpose:** The primary purpose of safety adaptations is to provide for understanding of and adherence to safety rules and procedures and safe use of materials, equipment, supplies, and chemicals.

### Safety Rules and Procedures

**Examples:**

- Understand safety and health rules and procedures
- Follow rules
- Material distribution
- Material and equipment use
- Preparation and clean up
- Sharing materials
- Time allocation

### Safe Use of Equipment

**Examples:**

- Role-playing
- Modeling - demonstrating
- Labeling
- Distribution of supplies and equipment
- Role and responsibility assignments
- Checklist - directions, procedures
- Timeline chart

## NEW JERSEY SCIENCE CURRICULUM FRAMEWORK SAMPLE ADAPTATIONS OF SELECTED LEARNING ACTIVITIES

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### *“Is it Alive?”*

#### **Selected Learning Activity #1**

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**Core Curriculum Content Standard: 5.6**

*(referred to in this document as “Science Standard 6”)*

**Indicator: 1**

**Page Number: 88**

**Grade Level: K-2**

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#### **Category of Adaptation:**

##### ***Instructional Presentation – Instructional Prompt***

**Feature analysis** *is a systematic procedure to help students understand and recall similarities and differences in related concepts through the categorization of information.*

1. Have students observe a “living” fish in water and several nonliving fish representations (e.g., a stuffed animal, a cutout figure of a fish, an animated cartoon, a computer graphic).
2. Conduct a teacher-led brainstorming activity, during which students generate characteristics of a “living fish” and a “nonliving” fish.
3. Based on the students’ responses, identify major categories that distinguish living and nonliving fish.
4. Use these categories to develop a feature analysis chart that summarizes the major characteristics discussed with the students.
5. Have students complete the feature analysis chart, checking their own responses against a teacher-generated answer key (see illustration).
6. Question and clarify incorrect responses.

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**Category of Adaptation:**

***Classroom Organization – Instructional Groups***

- Pairs of students conducting observations
- Whole-class brainstorming activity
- Individual completion of feature analysis chart

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**Category of Adaptation:**

***Classroom Organization – Instructional Support***

- Teacher-led brainstorming activity
- Teacher-created feature analysis chart and answer key
- Follow-up questioning of incorrect responses on the feature analysis chart

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**Category of Adaptation:**

***Classroom Organization – Environmental Conditions***

- Arrange stations for observations.

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**Category of Adaptation:**

***Student Response – Response Format & Procedures***

- Participation in the brainstorming activity
- Completion of the feature analysis chart
- Explanation of any incorrect responses; student self-correction

## Living vs Non-Living Fish

	<b>Moves Itself</b>	<b>Responds to Touch</b>	<b>Can Be Fed</b>	<b>Living Fish</b>	<b>Non-Living Fish</b>
<i>Graphic of Fish</i>					
<i>Fish in Water</i>					
<i>Stuffed Animal</i>					

	<b>Moves Itself</b>	<b>Responds to Touch</b>	<b>Can Be Fed</b>	<b>Living Fish</b>	<b>Non-Living Fish</b>
<i>Graphic of Fish</i>	–	–	–	–	+
<i>Fish in Water</i>	+	+	+	+	–
<i>Stuffed Animal</i>	–	–	–	–	+

## ***“Partner Convection Experiments”***

### **Selected Learning Activity #2**

**Core Curriculum Content Standard: 5.9**

*(referred to in this document as “Science Standard 9”)*

**Indicator: 4**

**Page Number: 170**

**Grade Level: 3-4**

#### **Category of Adaptation:**

##### ***Instructional Presentation – Instructional Prompt***

**Color coding helps students organize information and focus on key concepts and ideas.**

1. Keep students involved in the activity by using a teacher-created observation sheet.
2. Use a different food color for each procedure (e.g., *blue* for cold over cold; *orange*, hot over hot; *green*, warm over warm; *red*, hot over cold; and *purple*, cold over hot).
3. Color-code observations on observation sheet to correspond with color treatments.

#### **Category of Adaptation:**

##### ***Classroom Organization – Instructional Groups***

- Pairs rotate the roles of experimenter and observer.

#### **Category of Adaptation:**

##### ***Classroom Organization – Instructional Groups***

- Prepare color-coded observation sheet to help students sequence observations and organize and record responses

#### **Category of Adaptation:**

##### ***Safety Considerations – Safety Rules & Procedures***

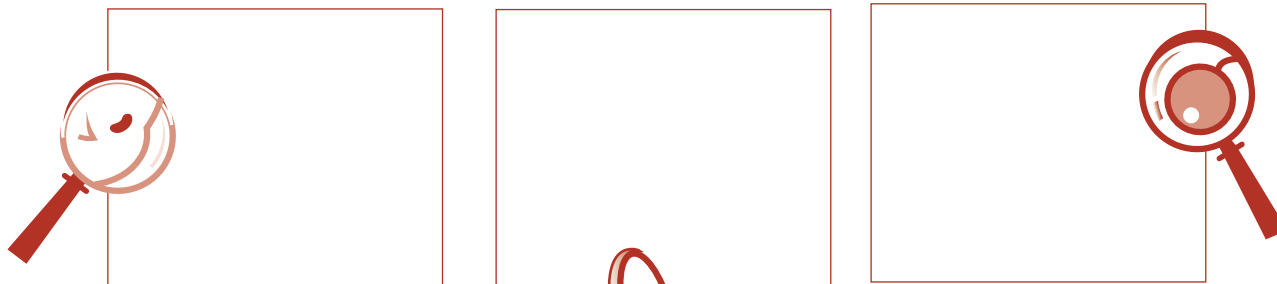
- Discuss safety precautions regarding use of hot water and glass jars.

# Student Observation Sheet: Describe Movement

**blue: cold over cold**

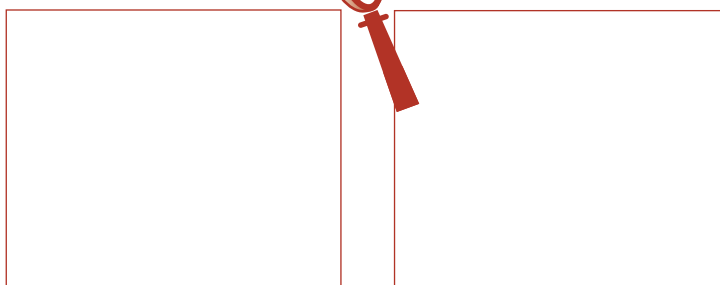
**orange: hot over hot**

**green: warm over warm**



**red: hot over cold**

**purple: cold over hot**



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***“Classifying Characteristics”*****Selected Learning Activity #3**

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**Core Curriculum Content Standard: 5.7***(referred to in this document as “Science Standard 7”)***Indicator: 7****Page Number: 121****Grade Level: 5-6**

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**Category of Adaptation:*****Instructional Presentation – Instructional Preparation***

***A demonstration helps to orient students to new activities, routines, procedures, or strategies. Through the use of physical, visual, and/or verbal models, students are introduced to the purpose of the lesson, the steps involved in a particular activity or routine, and the major concepts to be learned.***

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**Category of Adaptation:*****Instructional Monitoring – Think-aloud***

***A think-aloud is an example of cognitive strategy instruction, combining verbal mediation and cognitive behavior modification. Through the use of verbal models, students are exposed to various aspects of problem solving, including understanding the purpose of a task, having a plan of action, assessing progress, dealing with task difficulties, and revising actions.***

1. Instead of a whole-class activity, introduce this lesson using a “demonstration class model” that consists of a small group of students.
2. Using an overhead projector, develop a “mind map” that can serve as a visual model. With student input, narrow the student characteristics down to a single student (see illustration).
3. Conduct a teacher and/or expert-student “think-aloud” focused on the processes of observing, identifying, and narrowing classification categories (see illustration).

4. Videotape the class-model activity for future reinforcement and discussion of the classification process.
5. Repeat the activity with increasingly larger groups. Have each student complete a mind map that illustrates his or her unique quality as well as any similarities to other students.
6. On chart paper, create a class story that illustrates and describes the identified classification categories.

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**Category of Adaptation:*****Instructional Presentation – Instructional Monitoring***

- Videotape of the class model activity for reinforcement, review, discussion, and/or classification

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**Category of Adaptation:*****Classroom Organization – Instructional Groups***

- A small group of participants for the class model activity
- A buddy system to complete the mind map during the class model activity

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**Category of Adaptation:*****Classroom Organization – Instructional Support***

- Teacher think-aloud
- Teacher-created mind map

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**Category of Adaptation:*****Student Response – Format & Procedures***

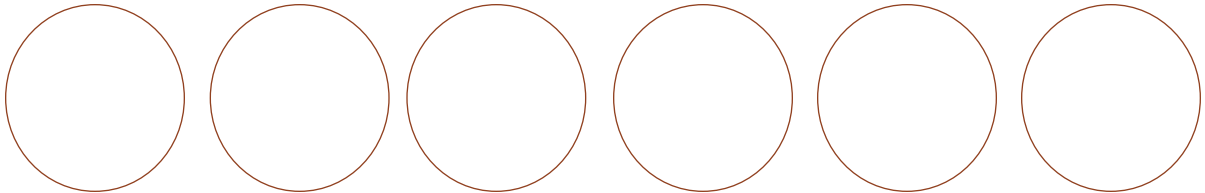
- Completion of mind map
- Participation in the development of class story



## Model Mind Map to Trace Back Student to Initial Characteristic

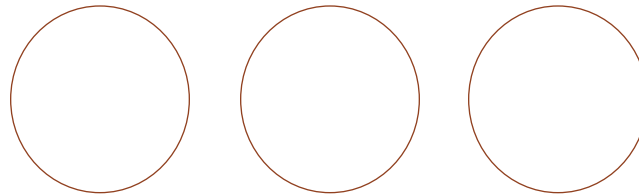
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### Characteristic: Boys



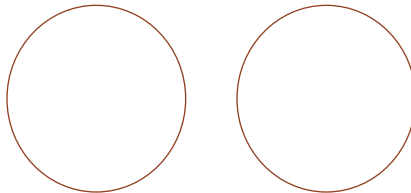
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### Characteristic: Brown Hair



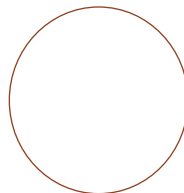
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### Characteristic: Brown Eyes



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### Characteristic: Left-Handed



*Color in the chain that links one student to the single characteristic*

## Sample Teacher Think-Aloud SHOW & TELL

### **“WHAT DO I HAVE TO DO?”**

*“Find a characteristic that these students have in common.”*

*“Okay, let’s see. Well, some of the students are boys!”*

### **“THAT WAS EASY!” “NOW WHAT?”**

*“Find a characteristic that the boys have in common.”*

*“Hair color—that’s a good one.  
Three of the boys have brown hair.”*

*“Now eye color.  
Two of the boys with brown hair have brown eyes.”*

### **“GOOD! THE GROUP IS GETTING SMALLER!”**

*“Next, I’ll ask how many of the boys with brown hair and brown eyes write with their left hand!  
That’s it! I’m down to one student.”*

**“Great! The end!!”**



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## ***“Bird Adaptations and Habitats”***

### **Selected Learning Activity #4**

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**Core Curriculum Content Standard: 5.7**

**Indicator: 9**

*(referred to in this document as “Science Standard 7”)*

**Page Number: 126**

**Grade Level: 5-6**

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#### **Category of Adaptation:**

#### ***Instructional Presentation – Instructional Application***

***A concept activity is a concrete presentation of abstract concepts. Using visual aids such as pictures or concrete materials, a concept activity helps to build connections and associations between new ideas and everyday experiences.***

1. Before beginning a discussion on bird adaptations, discuss human adaptations. This discussion provides students with a meaningful comparison based upon prior knowledge. For example, have students generate a list of foods. Ask the students to categorize the food according to the utensil used to eat that food type (e.g., a knife, fork, spoon, or hand).
2. With student input, list bird foods on the board, a piece of chart paper, or an overhead transparency, and categorize them according to the utensil used to eat that food type as above (e.g., a knife, fork, spoon, or hand).
3. Using illustrations of four bird beaks, students match the beak with a utensil:
  - Sharp beak = knife to rip
  - Pointed beak = fork to poke
  - Scooped bill = spoon to scoop
  - Large flat beak = hands to grasp and hold
4. Continue this concept activity by having students move in groups of four to different stations. Each member of the group represents a different type of beak and holds one of the items listed:
  - Staple remover = sharp beak (of a meat eater)
  - Toothpicks taped to fingernails = pointed beak (of a fruit eater)
  - Melon-ball scoop = scooped beak
  - Salad tongs = flat beak

5. Each station provides a variety of the foods suggested by the students. Challenge the students to identify which beak can be used to eat the different foods.
6. To complete this activity, have students in cooperative groups, match beak types with eating utensils. Then have students match beak types with bird foods using a teacher-created concept form.

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**Category of Adaptation:**

***Classroom Organization – Instructional Groups***

- Cooperative learning groups for concept matching activities:
  - Sharp beak
  - Pointed beak
  - Scooped beak
  - Large flat beak

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**Category of Adaptation:**

***Classroom Organization – Instructional Support***

- Teacher-generated concept activity form to organize categories and facilitate matches

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**Category of Adaptation:**

***Classroom Organization – Environmental Conditions***

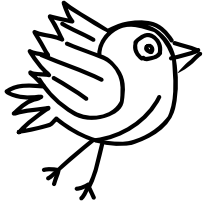
- Organize cooperative learning group seating arrangement and food stations

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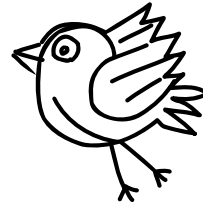
**Category of Adaptation:**

***Student Response – Response Format***

- Group responses provided on beak/food type concept activity form

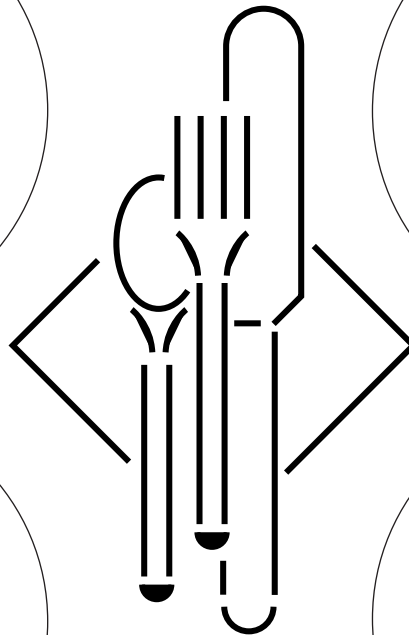


## Tweety's Tweets



**FORK**

**KNIFE**



**SPOON**

**HAND**

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***“Weather Journal”***  
**Selected Learning Activity #5**

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**Core Curriculum Content Standard: 5.10**

*(referred to in this document as “Science Standard 10”)*

**Indicator: 9**

**Page Number: 227**

**Grade Level: 5-6**

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**Category of Adaptation:**

***Instructional Presentation – Instructional Preparation (Warm-up)***

***An application activity encourages students to apply learned information in a practical way (e.g., conducting interviews, building a model, conducting observations, or developing illustrations).***

1. Prior to initiating daily weather observations, provide experience with weather forecasting. Direct a discussion about weather forecasts with questions such as the following: *Do you listen to weather forecasts? Why are forecasts useful? Are forecasts always correct?*
2. Using a variety of sources (e.g., newspaper, radio, television, Internet) organize weather stations and have students record weather forecasts.
3. Facilitate understanding of weather patterns and trends by having students keep a weather chart over an extended period of time (e.g., monthly patterns and comparisons; seasonal patterns and comparisons) (see illustration).

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**Category of Adaptation:**

***Classroom Organization – Instructional Groups***

- Weather forecast teams rotate among the four weather stations
- Organize weather stations
- Provide format for chart entries.

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**Category of Adaptation:**

***Classroom Organization – Environmental Conditions***

- Four labeled weather stations:
  - ✦ Newspaper
  - ✦ Radio
  - ✦ Television
  - ✦ Internet access

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**Category of Adaptation:**

***Student Response – Response Format***

- Record of weather chart entries



# Sample of Daily Journal

DAY 1



	Temperature	Cloud Formation	Precipitation	Wind Dir./Speed
newspaper				
outside				
internet				
T.V.				

DAY 2

Source	Temperature	Cloud Formation	Precipitation	Wind Dir./Speed
newspaper				
outside				
internet				
T.V.				

DAY 3

DAY 4

DAY 5

DAY 6

DAY 7

DAY 8

DAY 9

Source	Temperature	Cloud Formation	Precipitation	Wind Dir./Speed
newspaper				
outside				
internet				
T.V.				

*It may be appropriate to allow some students to use pictures or symbols to fill in the chart.*



cloudy



partly  
cloudy



sunny



windy



snowy



rainy



clear



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*“Tides”***Selected Learning Activity #6**

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**Core Curriculum Content Standard: 5.1.1****Indicator: 5***(referred to in this document as “Science Standard 11)***Page Number: 258****Grade Level: 5-6**

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**Category of Adaptation:*****Instructional Presentation – Instructional Prompt***

***A research outline or research guide is intended to guide a student through a research assignment in a content area and focus a student’s attention on the major ideas.***

1. Preview new terms with the students (e.g., *tidal bulge* and *azimuthal*).
2. Demonstrate how to create the paper and plastic-transparency model; prepare a procedure check-list for creating the model.
3. Provide tidal bulge/moon diagrams and Earth diagrams for students to copy or trace.
4. Model and have students color-code elements of the diagrams.
5. Provide students with a teacher-constructed research guide (see illustration).

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**Category of Adaptation:*****Classroom Organization – Instructional Groups***

- Small-group research teams with assigned roles: facilitatory, researcher(s), and recorder
- Rotate research teams through various reference materials
- Combine two groups and have them teach each other about one of the two subtopics:
  - ♦ the role of the moon in generating the ocean tides
  - ♦ an explanation of the different kinds of tides

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**Category of Adaptation:*****Classroom Organization – Instructional Support***

- Demonstrate paper and plastic-transparency model.
- Prepare a checklist for creating the paper and plastic-transparency model.
- Provide diagrams.
- Model the color-coding of the diagrams.
- Design a research guide.

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**Category of Adaptation:*****Classroom Organization – Environmental Conditions***

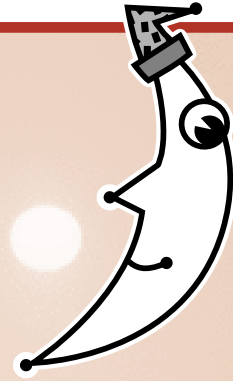
- Adequate space for creating the paper and plastic-transparency models
- Organize research stations
  - Encyclopedias
  - Reference materials on audiotape
  - Videotape
  - Internet access

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**Category of Adaptation:*****Student Response – Response Format & Procedure***

- Completed paper and plastic-transparency model
- Presentation by each group on tide subtopics
- Completed research guide and research report

## Tide Research Guide



1. What is a tide?
2. How are tides classified?
  - a. Describe high tide.
  - b. Describe low tide.
  - c. What is slack tide?
3. Explain what causes tides.
4. Describe the range of the tides.
  - a. What are spring tides?
  - b. What are neap tides?
5. How can the shape of the coastline affect the behavior of the tides?
6. How do tides affect erosion?
7. Explain an undertow.

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***“Rock Properties”***  
**Selected Learning Activity #7**

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**Core Curriculum Content Standard: 5.8**

*(referred to in this document as “Science Standard 8”)*

**Indicator: 4**

**Page Number: 143**

**Grade Level: 7-8**

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**Category of Adaptation:**

***Instructional Presentation – Instructional Monitoring***

***Segmenting, or dividing a task into component parts, helps the student organize information and responses into appropriate categories and follow a sequence of steps needed for task completion. Information organizers such as data charts can be used to segment information and/or responses. Similarly, physical containers can be useful in dividing specimens.***

1. Warm up students through a review of the properties of sedimentary, metamorphic, and igneous rocks.
2. Organize a “rock center” for students that includes a display of rocks and posters of rocks labeled by category.
3. Provide students with containers that have preconstructed divisions (such as egg cartons) for use in the sorting activity.
4. Have pairs of students sort rock samples by color, texture, size of grain or crystals, cleavage, hardness, etc.
5. Have student pairs sort rock samples into egg cartons labeled either *sedimentary*, *metamorphic*, or *igneous*. Once complete, each pair of students checks their results with the correct results in a teacher-made “answer box.”
6. Prepare a data chart, segmenting information by rock sample and characteristics (see illustration). Students record rock characteristics on this data chart.

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**Category of Adaptation:**

***Classroom Organization – Instructional Groups***

- Peer partners alternate roles: rock tester/experimenter and recorder

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**Category of Adaptation:**

***Classroom Organization – Instructional Support***

- Provide container for dividing rocks (e.g., an egg carton).
- Develop data chart for students to record rock characteristics.
- Provide answer box to facilitate student self-monitoring of accuracy during rock-sorting activity.

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**Category of Adaptation:**

***Classroom Organization – Environmental Conditions***

- Lab tables or flat workspace
- Rock-center learning station

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**Category of Adaptation:**

***Student Response – Response Format & Procedures***

- Data chart used to record observations
- Sorting rocks
- Self-monitoring check against teacher-constructed answer box

---

**Category of Adaptation:**

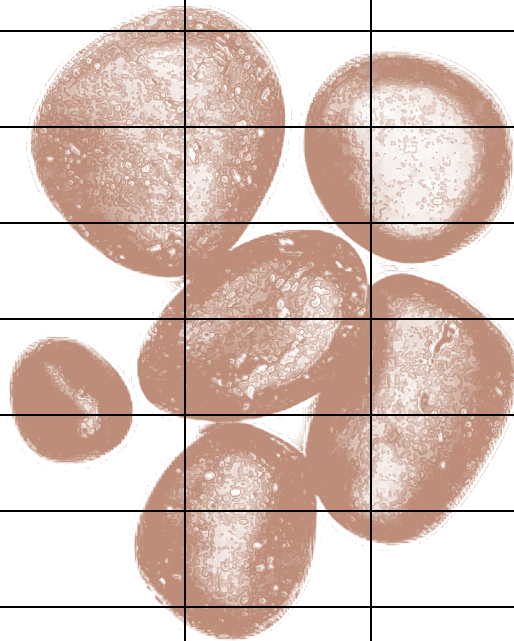
***Safety Considerations – Safety Rules & Procedures***

***Safe Use of Equipment***

- Discuss safe methods for testing hardness and cleavage.

# Rock Characteristics

SAMPLE ROCKS	COLOR	STREAK yes/no	GRAIN large/small	TEXTURE rough/smooth	NAME OF ROCK	TYPE - IGNEOUS Sedimentary or Metamorphic
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						



---

***“Energy Technology”***  
**Selected Learning Activity #8**

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**Core Curriculum Content Standard: 5.9**

*(referred to in this document as “Science Standard 9”)*

**Indicator: 13**

**Page Number: 187**

**Grade Level: 7-8**

---

**Category of Adaptation:**

***Instructional Presentation – Instructional Application***

***Simulation activities provide students an opportunity to act out real-life experiences in a controlled situation. Students have the opportunity to take another person’s role and/or experience risk taking. Simulations provide teachers an opportunity to lead a discussion concerning how the activity simulates the real world, the difficulties and insights students experience during the activity, and the relationships students discover between the simulation and the content being studied.***

1. Introduce the activity in a manner that relates the concepts of energy technology and energy conservation to the students’ everyday experiences and environments.
2. Begin the lesson with a brainstorming session about energy uses. Ask questions such as the following: *How is energy used in our school? Where can we observe energy being used in our school? How is energy being conserved or wasted in our school?* Record students’ responses on an overhead transparency.
3. Divide the class into small “survey” groups that will simulate an energy audit.
4. On a rotating basis, have each group simulate an energy audit of specific areas of the school building (e.g., hallways, offices, occupied and unoccupied classrooms, gymnasium, cafeteria and kitchen, auditorium). Have students record observations on a school energy survey (see “We Wondered about Wasted Watts!” illustration).
5. When groups complete their surveys, have them report and compare results.
6. Students can design awards for positive examples of energy conservation (e.g., Watts Watches).

---

**Category of Adaptation:**

***Classroom Organization – Instructional Groups***

- Whole-class brainstorming activity
- Small “survey” groups

---

**Category of Adaptation:**

***Classroom Organization – Instructional Support***

- Teacher-led brainstorming activity
- Teacher-generated school energy survey

---

**Category of Adaptation:**

***Classroom Organization – Adaptive Equipment***

- Overhead projector

---

**Category of Adaptation:**

***Student Response – Response Format & Procedure***

- Participation in a brainstorming activity
- Completion of a school energy survey form
- Participation in a discussion of survey results and comparisons



# We Wondered about Wasted Watts

## SCHOOL ENERGY SURVEY

ROOM NUMBER	# OF LIGHTS ON	RADIO ON	FAN ON	WINDOWS OPEN/AC ON	OTHER WASTED ENERGY

---

***“Investigating the Photosynthesis/Respiration Connection”*****Selected Learning Activity #9**

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**Core Curriculum Content Standard: 5.6***(referred to in this document as “Science Standard 6”)***Indicator: 16****Page Number: 107****Grade Level: 9-12**

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**Category of Adaptation:*****Instructional Presentation – Instructional Prompt***

**Graphic organizers** are visual representations intended to activate and direct thinking and to define the task for students. *Sequence chains and Venn diagrams are two types of graphic organizers.*

■ **Sequence chains** provide students with a visual display of steps or events in a process.

■ **Venn diagrams** can help students generate and represent comparisons of ideas, objects, events, or people. Differences between items being compared are placed in the outer regions; similarities are recorded in the overlap area. The degree of similarity can be represented by cutting out circles or ovals and adjusting the overlap section.

1. Review the significance of oxygen and light in photosynthesis.
2. Use a Venn Diagram to introduce, reinforce, summarize, and illustrate the relationship between photosynthesis and respiration in plants and animals (see illustration).
3. Use a sequence chain to introduce, reinforce, summarize, and illustrate the oxygen and carbon cycles (see illustration).
4. Use a sequence chain to introduce, reinforce, summarize, and illustrate the connection between photosynthesis and respiration (see illustration).

---

**Category of Adaptation:**

***Classroom Organization – Instructional Groups***

- Cooperative learning groups with rotating roles to conduct experiment:
  - Materials preparer
  - Observer
  - Recorder
  - Illustrator

---

**Category of Adaptation:**

***Classroom Organization – Instructional Support***

- Teacher-created Venn diagram and sequence chains to illustrate concepts and/or monitor student understanding

---

**Category of Adaptation:**

***Classroom Organization – Environmental Conditions***

- Adequate lab space for student involvement

---

**Category of Adaptation:**

***Student Response – Response Format***

- Responses on Venn diagram
- Responses on sequence chains

---

**Category of Adaptation:**

***Safety Considerations – Safety Rules & Procedures***

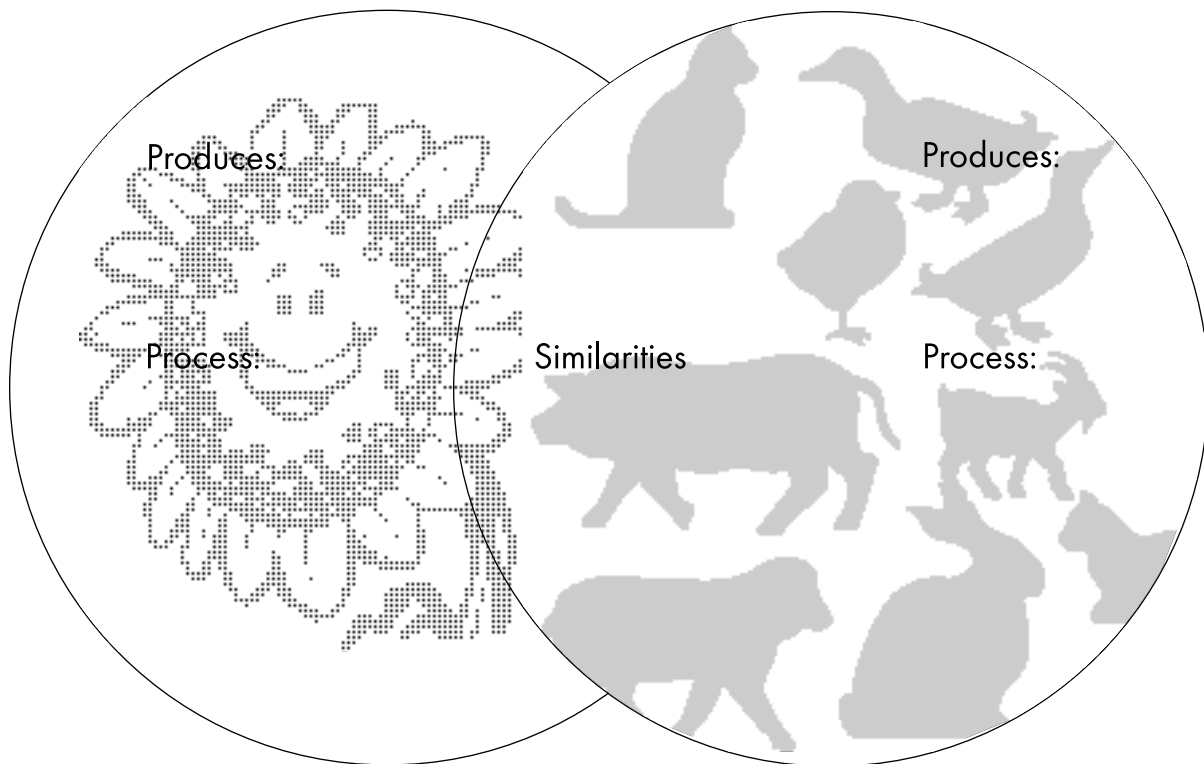
***Safe Use of Equipment***

- Discuss safety rules
  - Treatment of goldfish
  - Use of bromothymol blue
- Use a nonbreakable beaker

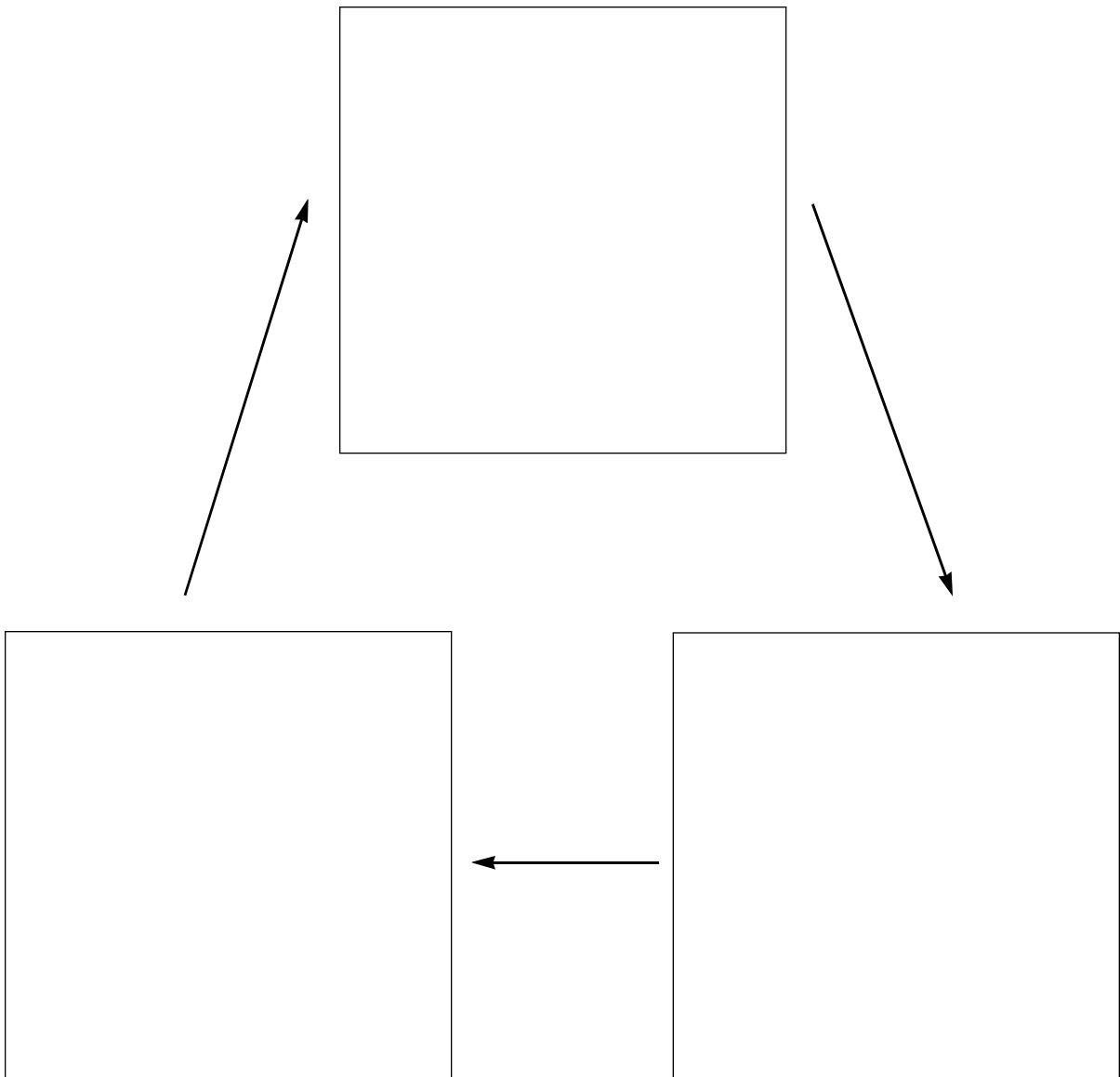
Venn Diagram  
Compare and Contrast  
PHOTOSYNTHESIS and RESPIRATION  
in PLANTS and ANIMALS

PLANTS

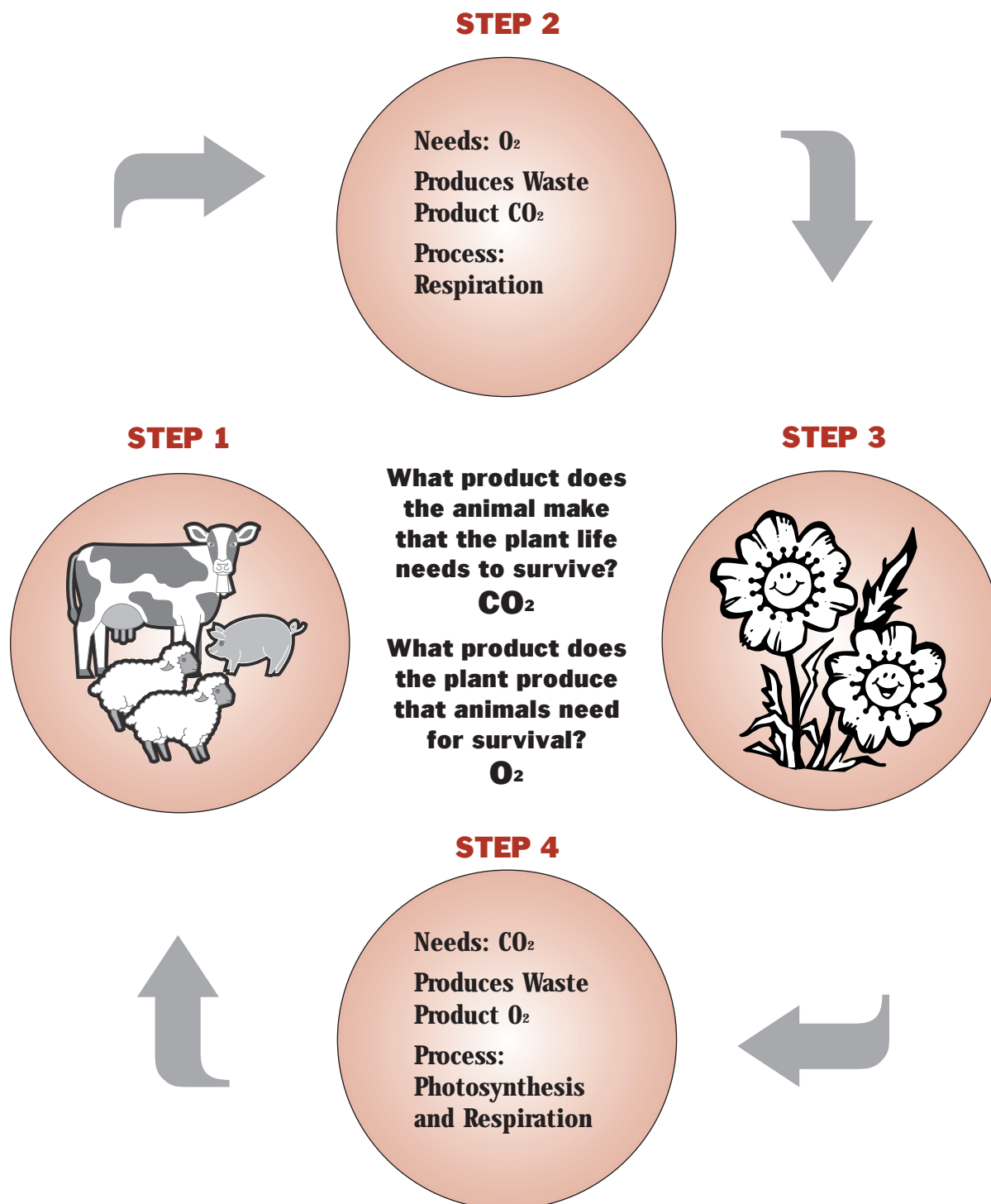
ANIMALS



A Sequence Chain:  
"Draw an Illustration of the Oxygen  
or Carbon Cycles."



# The Connection Between PHOTOSYNTHESIS and RESPIRATION



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***“Cost-Benefit Analysis”***

**Selected Learning Activity #10**

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**Core Curriculum Content Standard: 5.1.1**

*(referred to in this document as “Science Standard 11”)*

**Indicator: 9**

**Page Number: 269**

**Grade Level: 9-12**

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**Category of Adaptation:**

***Instructional Presentation – Instructional Preparation***

**K-W-L (What I Know, What I Want to Learn, What I Learned)** *is a teaching strategy that provides a framework to elicit background knowledge, engage student interest, categorize ideas and information, and direct attention to the purpose of a lesson or activity.*

---

**Category of Adaptation:**

***Instructional Presentation – Instructional Application***

**Information organizers** *present information or data in a chart, graph, or pictorial form to help students draw conclusions, identify cause and effect, categorize ideas, sequence events, show relationships, and organize thoughts.*

---

**Category of Adaptation:**

***Instructional Presentation – Instructional Application***

**Teacher-student conferences** *provide a process by which students may benefit from sharing, thinking, and reflecting on new learnings. Conferencing interactions help teachers monitor student interests, understandings, and associations. Conferences assist students in focusing attention, constructing meaning, and developing connections.*

1. Develop background information about NASA projects and spin-off projects through a video presentation, computer search, and/or magazine review.
2. Conduct a brainstorming activity, listing NASA projects students identified through the background building activity. Organize student responses on a K-W-L chart (see illustration).
3. As students further explore NASA projects, use a teacher-generated conference sheet and conduct student conferences to monitor understanding of the relationship between NASA projects, spin-off projects, and potential project outcomes.
4. Continue completion of the K-W-L chart, brainstorming costs and benefits of NASA project.
5. Organize debate teams.
6. Guide students through the development and use of an information organizer (e.g., a discussion web) that will be used to reflect their conclusion (cost-benefit analysis) about a specific NASA project.

---

**Category of Adaptation:*****Classroom Organization – Instructional Groups***

- Whole-class brainstorming activity; completion of a K-W-L chart.
- Individual teacher-student conferences
- Debate teams

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**Category of Adaptation:*****Classroom Organization – Instructional Support***

- Teacher-led brainstorming: K-W-L activity
- Teacher-created conference sheet; teacher-student conference
- Teacher-guided development of information organizer: discussion web

---

**Category of Adaptation:*****Classroom Organization – Adaptive Equipment***

- Video research material
- Computer research



---

**Category of Adaptation:**

**Student Response – Response Format & Procedures**

- Participation in brainstorming activities; research findings
- Teacher-student conference contributions
- Completion and discussion of information organizer (discussion web)
- Participation during debate

# K-W-L WORKSHEET FOR Space Exploration Benefits

## WHAT WE KNOW

NASA'S LARGE  
SCIENCE PROJECTS

SPIN OFF PROJECTS

## WHAT WE WANT TO FIND OUT FROM THIS ACTIVITY

COSTS  
FUNDING SOURCES

FUNDING  
APPROPRIATIONS

BENEFITS:

- Commercial
- Health
- Safety

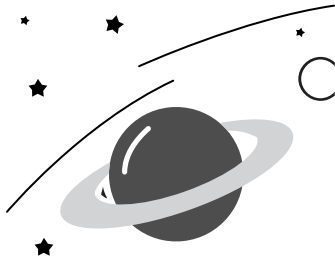
## WHAT WE LEARNED AND STILL NEED TO DETERMINE

COST-BENEFIT  
ANALYSIS

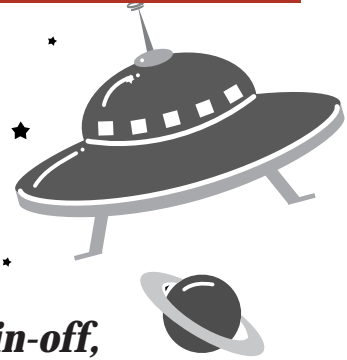
PROS

CONS

CONCLUSIONS



# CONFERENCE SHEET: Space Spin-Off



***Directions: If listed item is a space spin-off,  
check Yes/No and explain why?***

ITEM	YES	NO	WHY?

# Space Exploration Cost-Benefit Analysis

## Pros/Cons

**Pros +**

**Cons –**


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***“Identifying Risks”***

**Selected Learning Activity #11**

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**Core Curriculum Content Standard: 5.12**

*(referred to in this document as “Science Standard 12”)*

**Indicator: 9**

**Page Number: 298**

**Grade Level: 9-12**

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**Category of Adaptation:**

***Instructional Presentation – Instructional Preparation***

***Brainstorming is a group process used to activate a student’s prior knowledge and build associations to a specific topic. Ideas generated are not evaluated or criticized during the brainstorming activity. Student responses are recorded in list form.***

***Webbing is an activity frequently following the brainstorming process. During this procedure, a semantic map or web is developed based on categories derived from the “brainstorming” word list.***

---

**Category of Adaptation:**

***Instructional Presentation – Instructional Monitoring***

***A timeline chart or time tracking sheet is designed to provide students with a systematic means of planning, organizing, and using a schedule to complete a project such as a research assignment.***

1. Guide students through the research project by periodically conducting a brainstorming and webbing activity.
2. After students preview research materials, conduct a brainstorming session to determine what students are learning from their research efforts. List all responses generated by the students.

3. Have students identify clusters of information, such as time periods, scientific data, risk factors, and benefits.
4. Model the development of a web, translating the clusters of information into a visual representation. The web can help students organize and sequence information and develop an outline for the research report.
5. Repeat the brainstorming and webbing activity in order to monitor student progress and understanding (see illustration).
6. Provide students with a timeline chart. Assist them in developing a research and report writing schedule (see illustration).

---

**Category of Adaptation:*****Classroom Organization – Instructional Groups***

- Whole group: brainstorming activity
- Small group: research teams
- Individual: research reports

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**Category of Adaptation:*****Classroom Organization – Environmental Conditions***

- Teacher-led brainstorming and webbing activity to monitor student understanding of research information and help students organize material for research report
- Teacher-designed time-tracking sheet to assist students in planning a research report and using time effectively


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**Category of Adaptation:*****Student Response – Response Format & Procedures***

- Research report in each student's preferred response mode (e.g., written report, oral report, illustration)

## Research Timeline

**DATE****RESEARCH ACTIVITY**

<b>9/14</b>	<b><i>Survey Topic - Find out what's important (e.g. dates, people, events)</i></b>	
<b>9/21</b>	<b><i>Participate in brainstorming activity and identify key categories and issues</i></b>	
<b>9/21</b>	<b><i>Develop web showing major categories and issues</i></b>	
<b>9/22</b>	<b><i>Develop draft - outline</i></b>	
<b>9/22 - 9/30</b>	<b><i>Collect research information</i></b>	
<b>10/5</b>	<b><i>Participate in second brainstorming activity; add details to web</i></b>	
<b>10/6</b>	<b><i>Revise outline, if needed</i></b>	
<b>10/7 - 10/14</b>	<b><i>Develop first draft of research report</i></b>	
<b>10/21</b>	<b><i>Revise - final draft</i></b>	



# Risks

*Scientific  
Data*

*How Injuries  
Were Reduced*

**1960 - 1970**

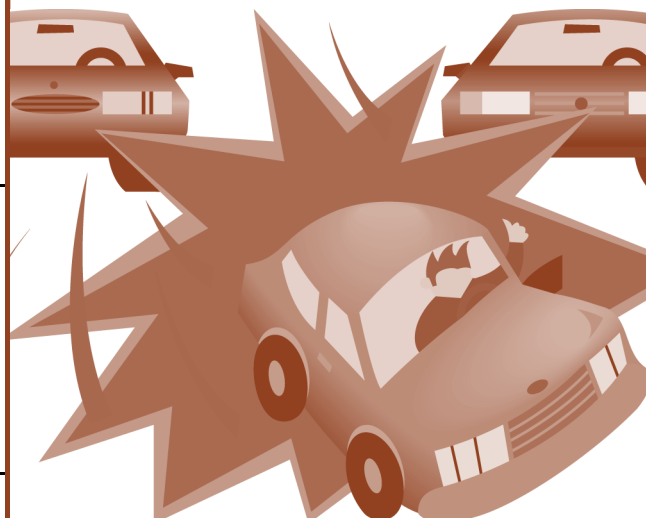
**Car injuries  
reduced by seat  
belts**

**1970 - 1980**

**1960 to Present**

**1980 - 1990**

**1990 -  
Present**



# Benefits



## REFERENCES

- Carroll County Public Schools. (1994). *Hands-on elementary science: grade 4*. Longmont, CO: Sopris West.
- Huck, R., Myers, R., and Wilson, J. (1989). *ADAPT: a developmental activity program for teachers*. Pittsburgh, PA: Allegheny Intermediate Unit.
- Mastropieri, M.A. and Scruggs, T.E. (1993). *A practical guide for teaching science to students with special needs in inclusive settings*. Austin, TX: Pro Ed.
- Pehrsson, J.E. Bean, T.W., and Baldwin, R.S. (1985). *Content area reading: an integrated approach*. Dubuque, Iowa: Kendell/Hunt Publishing Company.
- Tierney, R.J., Readence, J.E., and Dishner, E.K. (1995). *Reading strategies and practices: a compendium*. Needham Heights, MA: Allyn and Bacon.
- Weisgerber, R.A. (1995). *Science success for students with disabilities*. Menlo Park, CA: Addison-Wesley Publishing Company, Inc.
- Wood, J.W. (1992). *Adapting instruction for mainstreamed and at-risk students*. New York: Macmillian Publishing Company.
- Udvari-Solner, A. (1992). *Curricular adaptations: accommodating the instructional needs of diverse learners in the context of general education*. Topeka: Kansas State Board of Education.

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## **PART B: SCIENCE INSTRUCTIONAL ADAPTATIONS FOR STUDENTS WITH LIMITED ENGLISH PROFICIENCY**

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### **INTRODUCTION**

New learners of English are often overwhelmed by the language and culture of a new school setting. Most students entering New Jersey schools from other countries have acquired the ability to think, speak, and reason in their home languages. However, they come with various levels of schooling and life experiences. These factors, along with differences in learning styles and physical, social, and intellectual abilities, affect the students' progress in learning and must be considered in the design and delivery of their instructional programs. This chapter of the framework provides teachers of students with limited English proficiency (LEP) with examples and illustrations of specific adaptations for teaching in the content areas.

#### **Who are limited English proficient (LEP) students?**

- **Students moving to the United States from other countries whose native language is not English.**
- **Students coming from homes where the first language is not English.**
- **Students having difficulty speaking, reading, writing, and understanding the English language.**

Providing students who are linguistically and culturally diverse with an appropriate education is a national concern. The growing numbers of learners who are considered to be linguistically diverse represent a 38% increase over the past 10 years (*Census Reports*, 1993). A comparison of the Bilingual/ESL program enrollment in New Jersey between September 1987 and October 1997 shows that the number of limited English proficient students increased 41 percent during the 10-year period. New Jersey now ranks seventh in the nation in the number of LEP students. This diversity is further distinguished in the range of circumstances that inform students' identification as second language learners. With such vast differences in the demographic backgrounds of the students, teachers must have access to and use a variety of strategies and materials to address the individual needs of the learners.

Identifying the primary language and assessing the relative English and native language proficiency of students is a critical first step in providing LEP students with an effective language support program. These students vary greatly in their readiness for school, and this initial process of identification and assessment will enable educators to adapt the learning experience to the appropriate skill level of their students. When such practices are not followed, instruction is not as effective, and students struggle in misguided programs with little benefit. For students to prosper in their educational program, teachers need to know who their LEP students are and what these learners know and can do.

## THE PURPOSE OF ADAPTATIONS FOR ENGLISH LANGUAGE LEARNERS

Research supports the notion that children from different cultures or different economic levels differ meaningfully in how they learn. When the native language of the learner is different from the dominant language of the classroom, these differences become all the more pronounced. Regular classroom teachers need to be familiar with and have access to the literature that describes the educational needs of these students. In addition, all teachers, including mainstream educators and bilingual/ESL teachers, must work collaboratively in the sharing of ideas, strategies, and resources for making appropriate adaptations.

The purpose of adapting content lessons for English language learners is to lower the language barrier and make the English used in such lessons as comprehensible as possible. Two factors affect the comprehensibility of language:

- the degree to which the language used is contextualized through visible situations, and
- the level of text familiarity to the student's background knowledge and experience.

Thus, to be successfully communicative, the lessons must be designed to build upon the students' background knowledge and to rely on nonlinguistic cues so that LEP students can comprehend the material and the teacher's messages.

Students' initial progress will also depend on the level of literacy each attained in his or her first language. If a student is a good reader in L1 (the first language), he or she will be a good reader in L2 (the second language). Conversely, if a student is a poor reader in L1, then the same will hold true for L2. A major goal in bilingual education, therefore, is to ensure that while a student is learning a new language, cognitive development and literacy continue to develop without interruption.

## INSTRUCTIONAL STRATEGIES FOR THE LEP STUDENT

Adaptation strategies will vary depending on the language proficiency level of the LEP student. Initially, these learners understand little in English and will respond by guessing from context what is expected or by imitating other students. At this stage, the teacher should provide many visual cues, such as pictures, videos, filmstrips, picture books, and demonstration lessons, to aid understanding.

With increasing exposure to English, the LEP student will begin to understand simple language but may not be ready to produce language. During this "silent period," rather than force speaking, the teacher should focus on making speech comprehensible to the student by using simple language and visual aids. For example, the teacher says, "Open your book," as the student listens and observes the

teacher opening a textbook. This concurrent demonstration of behavior and modeling of spoken language enables the student to develop constructs (that is, to think) in English.

As the student begins to produce language, he or she will imitate words and phrases used by the teacher and other students but will make many errors. The teacher should support the student's efforts by responding positively to build self-confidence and correcting errors sensitively and judiciously. At this stage, the teacher continues to engage the learner in many classroom activities and asks him or her to respond to questions nonverbally or with simple one-word or short-phrase utterances. Evaluation of student's progress should focus on measuring understanding rather than production.

As the student begins to use speech creatively (spontaneously using previously learned language in a new way), he or she may continue to make many grammatical mistakes and have trouble understanding and producing the complex structures of academic language, even though he or she may appear or sound fluent in a social setting. The continuing aim should be to lower the language barrier by making classroom communication simple and clear. Information should be presented visually by means of graphic organizers, such as semantic webs, charts, and graphs as well as pictures. All students, particularly second language learners, should be encouraged to work in small-group activities, which provide ongoing opportunities to build language proficiency, self-confidence, and respect for the ideas of others. Keep in mind that being limited in English is a temporary situation and that students are capable of attaining full fluency in the language. A student's capacity to become fluent in English will be greatly enhanced by activities in oral and written language that connect to one's own life in meaningful and engaging ways.

The chart on the following page lists strategies to make classroom communication comprehensible to the LEP student. Many of these strategies are exemplified in the sample adaptations included at the end of this chapter.

### **GOOD TEACHING PRACTICES**

1. Learn the backgrounds of LEP students and, working with the ESL/bilingual teacher, plan a lesson that is both culturally and linguistically appropriate.
2. Group students flexibly, in small groups based on individual or group interests as well as instructional need or ability. These groups should be fluid and change, depending on the lesson objectives.
3. Give clear, simple directions to LEP students. Ask them to retell, in their own words, what you are asking them to do before they attempt a task.
4. Model a “lead and support” strategy where the content teacher leads the lesson as the ESL/ bilingual educator provides background information and examples that support the lesson.
5. Model a “shadow” strategy where the ESL/bilingual educator reiterates in the student’s native language or in simplified English the key concepts learned in content areas.
6. Paraphrase information and main ideas.
7. Reorganize and reinforce information.
8. Provide bilingual classroom resources, such as bilingual dictionaries, picture books and dictionaries, and English language encyclopedias for LEP students.

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### **Preparing the Students for the Lesson**

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LEP students need to develop a clear understanding of the teacher’s lesson objectives (e.g., Students will be able to understand the stages of the water cycle, the causes of the Civil War, or how to write a descriptive paragraph). They also need instruction that presents the main concepts of the lesson in a clear, concrete, and comprehensible manner and that excludes all nonessential or ancillary information. Help students conceptualize classroom lessons by translating ideas into concrete form through hands-on activities (e.g., conducting science experiments, recording notes in a learning log, or conducting an interview).

Because LEP students have such varied educational and life experiences, they may need more comprehensive background information than other students. Teachers should not take for granted that these learners will understand or have experience with some of the concepts being taught. The content area teachers should work with bilingual/ESL educators to identify specific problems confronting these students. Instructional preparation should also focus on:

**Building background information.** This can be done through brainstorming; semantic webbing; use of maps, photos, and illustrations; and use of the KWL strategy.

**Simplifying language for presentation.** Teachers can use “sheltered English,” in which they make content-specific language more comprehensible for LEP students by using short, simple syntactic structures; introducing one concept per sentence; limiting structures to one tense; using the active voice; substituting common words for unfamiliar vocabulary; and eliminating any unnecessary language or ideas.

**Developing content area vocabulary.** Vocabulary specific to the content area may be developed through various activities, including the following:

- starting a picture dictionary or word bank
- teaching the vocabulary appropriate to a given subject before introducing the content
- reviewing and reinforcing the vocabulary during the content activities
- labeling objects in the classroom
- taping vocabulary words in context so that students learn to recognize the words
- using realia (actual objects, such as a variety of foods or textures) as tools for teaching so that vocabulary becomes real and tangible
- encouraging students to use a dictionary to learn or confirm word meanings

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### Giving Directions

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Routines help create a secure learning environment in which LEP students are able to anticipate what will happen without having to rely solely on language cues. Expectations and routines such as arriving on time or checking homework should be communicated clearly and positively early in the school year so students have these structures to guide them. Working with buddies and peer tutors will also help second language learners acclimate to the school and classroom settings and routines.

Directions should be stated clearly and distinctly and delivered in both written and oral forms to ensure that LEP students understand the task. Students with limited English proficiency are further supported when they have access to a list of commonly used “directional” words such as *circle*, *write*, *draw*, *cut*, *read*, *fix*, *copy*, *underline*, *match*, *add*, and *subtract*. Students can work with a buddy or on their own to find these action words in a picture dictionary and to create their own illustrated file of direction words for future use.

## Presenting the Lesson

Because LEP students present such different learning styles and individual needs, teachers should incorporate a variety of strategies in daily classroom activities to ensure that instruction communicates meaningfully to each student. By using multiple strategies and varied instructional tools, teachers increase the opportunities for students to develop meaningful connections between the content and the language used in instruction.

## Teaching Strategies

- Simplify vocabulary and sentence structure so that language is uncomplicated and manageable. For example, substitute “begins” for “originates” or “People think” rather than “It is believed” for those students less able to grasp the language structure.
- Build connections and associations that link new knowledge to what students already know about a subject.
- Provide concrete examples through hands-on activities and techniques that make abstract concepts more comprehensible and enable students to construct meaning. Examples are listed in the chart below.

<b>graphic organizers</b>	<b>charts and graphs</b>	<b>surveys and interviews</b>	<b>drawing and illustrations</b>	<b>response journals</b>
<b>posters</b>	<b>simulations</b>	<b>labeling</b>	<b>tape recordings</b>	<b>word banks</b>
<b>games and puzzles</b>	<b>student-made flash</b>	<b>student-made books</b>	<b>language experience</b>	<b>role playing and drama</b>

- Promote understanding using demonstrations and think-alouds that model thinking processes and behavior.
- Present materials in a variety of ways: orally, visually, graphically, and auditorially.
- Elaborate on figurative language and idiomatic expressions, which are not universal figures of speech, through paraphrasing, use of concrete examples, and development of meaningful connections to the context and graphic representations.
- Emphasize key words and phrases using intonation and repetition.
- Summarize key points on the board or an overhead transparency as you speak and model the lesson.
- Include the English language learner in all classroom activities. The more the student feels a part of the class, the higher his or her motivation to learn English.

## Organizing the Classroom for Learning

Various classroom organizational patterns and tools can be used to help the LEP student grasp the content. Members of learning groups and pairs should be rotated in order to provide the student with varying language and learning style experiences within the classroom. Consider pairing second language learners with same-language peers. Other grouping strategies include the following:

- flexible grouping (mixed-ability groups based on students' interests/experiences; similar-ability groups based on students' needs/abilities; cooperative groups; or whole-class activities);
- paired learning (peer buddies, pairing more proficient second language learners with less proficient learners; or buddies, pairing same-grade native speakers with second language learners); and
- cross-age tutoring.

Additionally, teachers can draw on a number of instructional supports and resources to assist LEP students. Of particular value to these students is ongoing access to visual and auditory support for learning.

### INSTRUCTIONAL SUPPORTS

- Use of bilingual dictionaries in the classroom.
- Use of parent volunteers to tape, transcribe, or prepare a written explanation of difficult concepts in the native language.
- Collaboration between bilingual/ESL and mainstream classroom educators.
- Provision of content area lessons/topics on cassette tape or in written form for learners to take home to study as supplements to class discussion.
- Access to native language content texts, available through the library system, in nearby schools, or from parent or senior-citizen volunteers.

### ADDITIONAL RESOURCES

- Close-captioned video or TV
- Franklin speaking dictionaries
- Electronic translators
- Computer programs
- Teacher-made adaptations, outlines, and study guides
- High interest/low-reading-level content materials
- Books with audio tapes
- Music plus tape recorder (slows down speech on tape)
- Native language reference materials
- Specially taped materials for bilingual/ESL classrooms



## CHECKING FOR STUDENT UNDERSTANDING

Teachers need to use a variety of strategies for monitoring student progress and to adjust their strategies and expectations to fit the level of language proficiency of the English language learner. With beginning language learners, emphasis should be on comprehension of named things and actions; more advanced students should begin demonstrating understanding of connections between things and subsequently their ability to articulate the relationship between ideas. Content area teachers should work closely with the bilingual/ESL teacher to identify instructional and assessment strategies that are appropriate to all aspects of the student's development and that permit teachers to expand expectations gradually over the school year.

Successful strategies for monitoring student progress in the content areas include:

- Providing periodic checks for understanding.
- Promoting nonverbal as well as verbal participation.
- Encouraging students to think aloud to practice concepts.
- Modeling responses that provide appropriate information using correct grammar.
- Breaking tasks down into sequentially developed parts using simple language.
- Structuring questions to student's language level (e.g., begin with yes/no and embedded questions and advance to open-ended questions).
- Avoiding use of questioning techniques that contain negative structures, such as "all but", "everything is \_\_\_\_\_ except", or "one is NOT the reason/cause."
- Rephrasing questions and information when students do not understand the first time.
- Observing student's behaviors for evidence that they understand assignments, directions, and instructions.
- Reviewing student's work for evidence that they understand assignments, directions, and instructions.
- Using visual reviews (e.g., lists and charts) that enable students to show what they know and can do.
- Providing increased "wait time" to allow students time to process questions before responding.
- Providing modified "double" grading to assess the content as well as the structure of responses.

Four over-arching strategies are most effective for assisting students from a background of limited English proficiency (LEP) to meet success in content area classes. These strategies include the following:

- integrate activities into thematic units
- tap students' prior knowledge and experience
- teach learning strategies and scaffold complex tasks
- group students into a variety of learning groups

Each of these strategies will be expanded below with specific practices to assist English language learners. Following this, content-specific strategies and sample lesson plans are offered at various grade-level clusters based on the major strategies below. In all cases, the lessons were designed for use with a content area class consisting of five LEP students, 15 or more native English speakers, and a content area teacher. The LEP students participate most fully if they have attained at least an intermediate language proficiency level. For students below that level, the ESL teacher should take the lead in presenting content information.

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### Strategies for Instruction

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1. **Integrate activities into thematic units.** One of the ways students learn best is through repetition: of ideas, of words, of actions. When concepts to be developed are being reinforced across several content areas, students benefit from seeing and hearing the same information or vocabulary over and over. English language learners will have more opportunities to use key words and practice desired skills when they work with the same concepts in several classes. Developing and teaching thematic units across content areas takes joint planning by a number of teachers. Certainly, the ESL teacher needs to be involved in the planning. In many cases, the ESL class can reinforce the language skills needed by the students to successfully complete the content area activities. Often, the ESL teacher can suggest ways to assess the student's understanding without depending heavily on language-based tests. In the case of thematic approaches to learning, it is certainly true that "many hands lighten the load."
2. **Tap student's prior knowledge and experience, which differ from that of other students in the class.** In the case of immigrant students as well as others who are acquiring English, prior knowledge cannot be taken for granted. Before introducing a new unit or concept, it is wise to find out what information students already have about it. However, students who have not lived in New Jersey all their lives may have a very different background understanding than those born here. The entire class can be multiculturally enriched, but the need to tap into a variety of students' perceptions and experiences still exists. For example, a New Jersey student's understanding of elephant, ostrich, and llama may simply reflect animals found in a zoo. On the other hand, students from Thailand, Australia, and Peru may think of them as farm animals.

With regard to concepts that are typically American (historical figures, artists, fast foods), teachers are advised to expect little or no background knowledge and to "build in first-hand experiences." References to television programs, holiday practices, or geographic areas may mean nothing to LEP students. They will not have mental maps of the United States to draw from when Seattle or Miami are mentioned. They will not be likely to defend the Redskins against the Cowboys, or recognize fireworks as symbolic of July. They will, most likely, know distances to other cities, follow other sports teams, or celebrate different holidays. Teachers need to make every effort to explain concepts related to the lesson; a peer tutor can be enlisted in explaining concepts to LEP students.

3. **Teach learning strategies and scaffold complex tasks.** Much has been written recently about students' needs to develop strategies for learning. Some learners have developed a few strategies to help make sense of their learning. Now, teachers at all levels are encouraged to model and demonstrate thinking and learning strategies. Graphic organizers are invaluable tools to create visual relationships between concepts. All students benefit when information is organized graphically for them. Overtly teaching students to reflect on how they are doing, what they are understanding, and what else they need to know will help them to be successful. Appealing to multiple intelligences within the context of a single unit of study enables students to develop or enhance a variety of skill areas. English language learners may have developed strategies different from those of other students. They can be encouraged to share their own learning approaches with the whole class since it builds self-esteem.

English language learners need to be challenged by complex concepts, but they will be better able to grasp complexities if tasks or information is scaffolded by what has gone before. As with the effectiveness of thematic units, scaffolding learning by building in foundation skills will aid LEP students' understanding.

4. **Group students into a variety of learning groups.** English is learned most efficiently when it is used to conduct meaningful, natural communication. To encourage English learning, students need many opportunities to talk, use new vocabulary, and to share ideas with their peers. These opportunities are most available to them when they learn in cooperative learning groups, pairs, or other small-group settings. In classes with native speakers of English, LEP students will hear the content area language modeled by their peers, and have more chance to use it when they participate in group work. Students who have not yet attained intermediate proficiency can shadow the work of a native-English-speaking peer in paired work. Students with greater ability can contribute their ideas in groups of four or five while someone else restates the comments in standard oral or written form. Groups can be formed and disbanded into a variety of sizes depending on the nature of the task. LEP students can be grouped together to develop some background cultural knowledge; then a single language learner can be matched with three native speakers to complete a graphic organizer. However, in all cases, limited English learners benefit from working with peers and from having more chances to use the language.

## SCIENCE AND THE LEP STUDENT

The suggested strategies and adaptations offered above will prove helpful to any teacher of students with limited command of English, and can be used to modify virtually every teaching activity. The science classroom, with a regular and heavy reliance on “hands on” exploration of each student’s world, can provide a unique opportunity for the LEP student to display his/her abilities, less restricted by difficulties with language. Hence, science instruction can especially benefit from an application of these ideas, and it is recommended that the LEP science teacher regularly refer to these pages when planning investigative activities.

Particularly useful strategies for enhancing “hands-on” investigations include:

- Label objects, apparatus, models, organisms and their parts, etc. as an activity is being explained.
- Model investigative procedures and techniques. Do not rely on a set of written directions from a lab manual.
- Assemble lab teams in a way that provides the LEP student with comfort and assistance as well as diversity.
- Maintain a classroom/laboratory with labeled exhibits, such as weather station, in an attempt to display the instruments and tools used by scientists.
- Science Standard #3 calls for understanding the contributions of many cultures throughout history to the development of science. Seek opportunities to include these contributions regularly in your teaching.

## SCIENCE INSTRUCTIONAL STRATEGIES FOR LEP STUDENTS

Suggested strategies for adapting science instruction for LEP students are given on the following pages, alongside the learning activities. The four sets of strategies were designed to illustrate science instructional adaptations at the K-2, 3-4, 5-8, and 9-12 grade levels, respectively.

Science Standard 10 – Indicator 3 (Gr. K-2)  
 Science Standard 10 – Indicator 4 (Gr. 3-4)  
 Science Standard 12 – Indicator 4 (Gr. 5-8)  
 Science Standard 6 – Indicator 17 (Gr. 9-12)

## SCIENCE STANDARD 6

*All students will gain an understanding of the structure, characteristics, and basic needs of organisms.*

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**Indicator 17:** *Compare and contrast the life cycles of living things as they interact with ecosystems.*

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### LEARNING DEMONSTRATION ACTIVITIES: Grades 9-12

**Effect of Environmental Factors on Germinating Seeds.** In the following activities, students investigate the response of the roots and stems of germinating corn or bean seeds to such environmental factors as gravity, light, and water.

- To investigate the response of germinating roots and stems to gravity, students place four soaked corn or bean seeds on barely moist paper towels that are pressed into a petri dish. The seeds should be at the 3 o'clock, 6 o'clock, 9 o'clock, and 12 o'clock positions. The students then stand the petri dish on edge in a fixed position and check daily for the direction of growth of the emerging root and shoot.
- As an extension, students work in cooperative lab groups to design their own experiments testing the responses of germinating seeds to the direction of a light source or a water source. Students focus not only on the design of their experiments but also on writing detailed procedures. (They will swap experimental designs and procedures with another group before carrying out the experiment.)

#### Strategies for LEP students:

Demonstration lessons by the teacher provide students with a model for thinking, writing, reading, speaking, and communicating in a new language.

Hands-on project work assists students in understanding concepts that link new knowledge to previously learned knowledge and experiences in one's own culture.

Journal writing is an excellent activity for students to synthesize, analyze, and reflect on their reading, learning, and life experiences.

Working to ensure students understanding can be achieved through expanding, restating, and reinforcing important points.

## SCIENCE STANDARD 10

*All students will gain an understanding of the structure, dynamics, and geophysical systems of the earth.*

**Indicator 3:** *Identify major sources and uses of water, discussing the forms in which it appears.*

### LEARNING DEMONSTRATION ACTIVITIES: Grades K-2

**Water-Cycle Plays.** Student groups create and act out stories about the water cycle. Using some type of costuming or pictures on craft sticks, the students depict the travels of a water droplet through the water cycle, e.g.,

- A raindrop forms in a cloud and falls on a hill.
- It runs into a stream, which flows into a river, a bay, and the ocean.
- It evaporates and goes into a cloud, and the cycle continues.

Play audiotapes of environmental sounds (e.g., rain, rushing streams, or waves on a beach) while students act out their plays.

Help students realize that some water is “held up” in lakes, aquifers, and puddles and so is not flowing through the water cycle. Discuss with them how water is used by plants and animals (including humans). Students can collect pictures of how people use water and create a classroom display.

**Forms of Water.** Students pour some water into a clear container, then mark how high the water level is. They observe what the water looks like in its liquid state. They then freeze the water until it is completely solid. Ask students to predict what will happen to the volume (height) of the water. They can

#### Strategies for LEP students:

Acting out a story is another way to help kids think actively and to visualize what they learned.

Hearing recorded sounds or listening to books on audiotapes helps students to hear the language spoken with modeled voice intonation and pronunciation.

Forms of Water. Students pour some water into a clear container, then mark how high the water level is. They act with ecosystems.

Teaching the same concepts to all students through differentiated instruction allows the teacher to address different learning styles, abilities, and varied learning experiences.

Assist the LEP student by labeling objects and pointing to those objects as the activity is being explained and modeled.

Pair a less proficient with a more proficient English-speaking student to encourage risk-taking and increase the student’s comfort level.

draw pictures or write journal entries to show their predictions. The students observe the ice to see how the water has changed in appearance and size.

After marking the level of the ice, the students lightly cover the cups with plastic wrap (to prevent evaporation) and let the ice melt completely. They again observe the water and its volume. They compare the volume of the water in the liquid state before and after it was frozen.

Students discuss occasions when they have noticed that water seemed to disappear. They then fill two cups with water and cover only one cup with plastic wrap. They place both cups of water on a windowsill. The students observe and record the height of the water in each cup daily. What is happening to the water? Where has it gone?

## SCIENCE STANDARD 10

*All students will gain an understanding of the structure, dynamics, and geophysical systems of the earth.*

**Indicator 4:** *Collect and record weather data to identify existing weather conditions, and recognize how those conditions affect our daily lives.*

### LEARNING DEMONSTRATION ACTIVITIES: Grades 3-4

**Weather Station.** Students establish a class weather station using homemade or basic instrumentation such as a thermometer, barometer, rain gauge, wind vane, and anemometer.

**Daily Weather Journals.** Students write daily weather conditions in their weather journals. Entries might include

- readings from the instrumentation in their class weather station
- observations regarding cloud types, condition of air, amount and kind of precipitation
- present weather conditions obtained from a weather center (e.g., radio, television, or Internet)

In their journal entries, students could also write about the type of clothing they could wear outdoors and what activities they could do that day.

Students examine their data and learn to recognize certain patterns of seasons (e.g., storms vs. fair weather). Challenge students to examine their data more closely by asking them if there is any connection between their barometer readings and the prevailing weather conditions. The students can create video or multimedia presentations reporting their discoveries.

#### Strategies for LEP students:

The K-W-L strategy (what you know, what you want to learn, what you learned) aids students' comprehension and vocabulary development, enabling them to connect the new to the known.

K	W	L

Place a copy of the daily weather map on bulletin board for student reference.

Develop a set of flash cards with weather terms so those students can use them to review the terms used in weather reporting.

Choose favorite science and informational books for weekly shared reading so that LEP students hear and appreciate the beauty of both written and spoken language.



## SCIENCE STANDARD 12

*All students will develop an understanding of the environment as a system of interdependent components affected by human activity and natural phenomena.*

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**Indicator 4:** *Evaluate the impact of personal and societal on the local and global environments.*

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### LEARNING DEMONSTRATION ACTIVITIES: Grades 5-8

**Providing Basic Needs.** Students first discuss the basic needs of humans (e.g., water, air, shelter, food, open space). Obtain a piece of rope long enough to form a circle for the entire group to step into and stand comfortably, then place the rope on the ground. Ask the students to step inside the circle, then instruct them to step outside the circle. Explain to the group that part of their environment has been impacted due to development. Reduce the size of the rope, and ask the group to again enter the space provided inside the circle. Decrease the size of the circle using various issues that pertain to the loss of habitat or of a basic need (e.g., water pollution, roadways, litter).

Ask the group to explain what happened as they lost a portion of area or of that resource. Discuss how both plant and animal species in this area might adapt and deal with the changing situation. What are their options? Challenge the group to identify potential solutions that would prevent such losses, or have them bring in newspaper articles that represent this occurrence.

#### Strategies for LEP students:

Draw on prior knowledge and have students brainstorm and think about what they and others need in order to survive each day. Ask them to list what they already know about the environment and identify ways that we impact on local and global environments.

Identify and share specific vocabulary words several days prior to the introduced lesson so those students can learn and use new words in meaningful contexts.

Keeping a vocabulary notebook is helpful to students. This medium gives the LEP student a tool for seeing and copying words in context, and using words in a language that is understandable to them.

Using a variety of visual clues like encyclopedias, informational books, newspapers, magazines, and bilingual dictionaries increases students understanding of difficult concepts.

### REFERENCES

- Census reports sharp increase in number of non-English language speaking Americans. (1993, May). *NABE NEWS*, p.1.
- Chamot, Anna Uhl ,& O'Malley, J. Michael. (1994). *The CALLA handbook: Implementing the cognitive academic language learning approach*. MA: Addison-Wesley.
- Collier, Virginia P. (1995). *Promoting academic success for ESL students: Understanding second language acquisition for school*. Elizabeth, NJ: NJTESOL-BE (P.O. Box 2203, Elizabeth, NJ 07207).
- Teachers of English to Speakers of Other Languages. (1997). *ESL standards for preK-12 students*. Alexandria, VA: Author (1600 Cameron Street, Suite 300, Alexandria, VA).  
<E-mail: [HYPERLINK mailto: tesol@tesol.org](mailto:tesol@tesol.org) Web Web site: [HYPERLINK http://www.tesol.org](http://www.tesol.org)>
- Eastern Stream Center on Resources and Training. (1992). *Help! They don't speak English starter kit for elementary teachers*. Oneonta, NY: Author.
- O'Malley, J. Michael, & Valdez Pierce, Lorraine. (1996). *Authentic assessment for English language learners: Practical approaches for teachers*. MA: Addison-Wesley.
- Short, Deborah J. (1991). *Integrating language and content instruction: Strategies and techniques*. Washington, DC: National Clearinghouse for Bilingual Education.

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## PART C: SCIENCE INSTRUCTIONAL ADAPTATIONS FOR EXCEPTIONALLY ABLE STUDENTS

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### INTRODUCTION

When implementing the *Core Curriculum Content Standards*, schools must provide all students with appropriate challenges so that raised expectations do not result in lowered expectations for the exceptionally able. Gifted students remain in regular classrooms for the better part of the day and are pulled out for enrichment for a designated amount of time. As a result, teachers face the challenge of accommodating the gifted student in the regular classroom.

Gifted learners are oftentimes overlooked in classroom instruction. Consequently, some students find school boring and uninspiring due to knowing many of the concepts being introduced in the regular classroom. The exceptionally able or gifted students are those who

- demonstrate a high degree of intellectual, creative, and/or artistic ability
- possess exceptional leadership skills
- excel in specific fields
- function above grade level
- need accommodations or special instruction to achieve at levels commensurate with a challenge to his or her abilities
- have the ability to grasp concepts rapidly and/or intuitively
- have an intense curiosity about principles and how things work
- have the ability to generate theories and hypotheses and pursue methods of inquiry
- produce products that express insight, creativity and/or excellence

In the past, the term “gifted” described people with high scores on I.Q. tests. Today, new concepts connected to creative thinking models and multiple intelligences have expanded the definition of intelligence to include other dimensions. Giftedness reflects a multifaceted, multicultural, and multidimensional perspective and is defined by aptitude, traits, and behaviors rather than changeless test performance. These students are found in all cultural groups and across all economic levels. Increased understanding of culturally determined and environmentally affected behaviors will enable teachers and administrators to interpret performance indicators of creative potential.

The process of identification is ongoing because students are continuously entering and exiting school districts. Fluidity should be maintained as students’ needs change each year. Identification and placement in a gifted program should be initiated in kindergarten and reviewed annually through grade 12. Identification practices should be in place at the time of school enrollment. Selection of a pool of nominees and final selection of participants should be determined by a committee of at least three to five individuals in order to maintain a fair and democratic process.

## STRATEGIES FOR THE EXCEPTIONALLY ABLE LEARNER

“Differentiating the curriculum” refers to appropriate adjustments to content, teaching strategies, expectations of student mastery, and scope and sequence. In a differentiated classroom, students work at different paces. Gifted students are more likely to develop study and production skills, experience success and struggle, and feel challenged in a classroom setting that encourages learners to master information more quickly.

Adaptation strategies include the following:

- interdisciplinary and problem-based assignments with planned scope and sequence
- advance, accelerated, or compacted content
- abstract and advanced higher-level thinking
- allowance for individual student interests
- assignments geared to development in areas of affect, creativity, cognition, and research skills
- complex, in-depth assignments
- diverse enrichment that broadens learning
- variety in types of resources
- community involvement
- cultural diversity
- internship, mentorship, and other forms of apprenticeship

Adaptation categories include *acceleration*, *enrichment*, and *grouping*. The recommendations on the following pages identify a variety of adaptive efforts within these categories.

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### Acceleration

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**Acceleration** involves *grade skipping or changing the rate of presentation of the general curriculum to enable the students to complete the program in less time than usual. Prescribed seat-time is not necessary for achievement of the standards. Acceleration can occur in any subject area. Middle school students should be able to take high school courses; high school students should be able to take college courses with appropriate credit accrued. Some provision must be made for continued acceleration or high-level enrichment. Unless the student has a pre-identified problem, social or emotional development should not inhibit acceleration.*

Examples of accelerated types of programs are described below.

**Flexible pacing.** Assignment to classes is on the basis of ability to be challenged as well as ability to handle the work; assignment should not be age discriminatory.

**Content acceleration.** Superior performance in some areas may be addressed with placement in a higher grade level for the areas warranting it.

**Early entrance to school.** Eligibility should be evaluated in terms of (1) degree of advancement in relation to peers; (2) number of areas of advanced achievement; and (3) student's self-concept. The percentage of students attending one to three years of preschool has increased dramatically and should be considered.

**Multiage classes.** Two or more grade levels are combined in multiage classes. Students can accelerate through self-pacing.

**Compacting.** Compacting, also known as telescoping, refers to a form of acceleration in which part of the curriculum is covered in a shorter-than-usual period of time. Previously mastered content materials are determined through pre-evaluation and elimination.

**College course work.** Qualified students take college courses for college credits while completing high school requirements (concurrent enrollment). College courses may be taken in the summer.

**Early college work.** Once the standards for high school courses are met, early admission to college is an option. Students may leave high school early and enter college.

**Advanced placement.** The advanced placement program (APP), administered by the College Entrance Examination Board, enables high school students to obtain both high school and college credit for demanding course work offered as part of the school curriculum.

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### Enrichment

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**Enrichment** *is another way to meet the differentiated needs of exceptionally able students. Well-articulated assignments that require cognitive processing, in-depth content, and alternate modes of communication can be effective and stimulating.*

The following are some examples to consider when differentiating classroom instruction to meet the needs of academically talented students:

**Alternate learning activities/units.** Opportunities to pursue alternate activities permit students to engage in new learning and avoid the boredom of repeating instruction or unnecessary practice in skills already mastered.

**Independent study.** Students conduct planned, self-directed research projects carefully monitored by the teacher. Prerequisites include instruction in field-based and library research skills, the scientific method, and other authentic types of inquiry.

**Advanced thinking processes.** Provide assignments in all curriculum areas emphasizing higher-level thinking skills such as synthesis, analysis, and evaluation.

**Guest speakers.** Guest speakers provide information on topics beyond the teacher's expertise. University, faculty, parents, business and industry leaders, or other teachers in specific areas may be used as resources.

**Mentors/internships.** Allow students to interact with adult experts in the field of mutual interest. Mentors act as role models. Student's areas of interest, as part of career awareness, should be considered.

**Alternate resources:** Use materials from a higher grade level. Access to business, university, and community resources (such as laboratories, libraries, and computer facilities) are appropriate.

**Exchange programs.** Students attend schools in a different community or country to enrich educational experiences.

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## Grouping

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**Grouping** *students of like ability together in homogeneous arrangements such as special classes or* **clustering** *in the same classroom allows for more appropriate, rapid, and advanced instruction without isolating the exceptionally able student. Research indicates that gifted students are more likely to socialize “normally” when they are with students who share their interests and learning styles. When cooperative learning has been used in the regular classroom, gifted students sometimes become tutors for other students, and, therefore, learn less academic content. Flexible grouping is recommended in the regular classroom to give gifted students an opportunity for development of advanced skills, including skills of expression and production. Grouping flexibly allows exceptionally able students time for advanced work and a chance for independent study.*

Students may be grouped using the following scheduling arrangements or project emphases:

**Self-contained classes.** Enable exceptional students to be challenged in every area throughout the day and week, to be stimulated by their intellectual peers, and to have guidance from teachers with experience in sequential, integrated curriculum for the exceptionally able.

**Pullout programs.** Combine regular class integration and homogeneous grouping on a part-time, regular basis. Pullout programs require careful coordination and communication between the teachers of both classes.

**Cluster grouping in the regular classroom.** Cluster grouping permits homogeneous and heterogeneous grouping according to interests and achievement.

**Cluster scheduling.** Arrange schedules so that exceptionally able students can take their required core courses together to enhance rapid pacing, less drill, and greater depth and breadth.

**Honors and enrichment classes.** Provide opportunities for practicing higher-level thinking skills, creativity, and exploration of in-depth course content.

**Seminars.** Seminars are aimed at research, interdisciplinary studies, visual and performing arts, academic subjects, or other areas of interest. These seminars provide interaction with specialists who can give guidance in specific areas. Gifted specialists can be powerful resources to assist in teacher in-service programs.

**Resource centers.** Districts should establish a resource center that is available to all students. It may be a good idea to reserve designated time to utilize these facilities for exceptionally able students from a broader geographical area (e.g., interdistrict or countywide).

## REFERENCES

- Association for Supervision and Curriculum Development. (1994). *Challenging the gifted in the regular classroom: Facilitator's guide*. Alexandria, VA: ASCD.
- Reis, S. M., Burns, D. E., and Renzulli, J.S. (1992). *Curriculum compacting: The complete guide to modifying the regular curriculum for high ability students*. Mansfield Center, CT: Creative Learning Press.